Franklin County Public Safety Specific
ALS Protocol: FCPS-7
SMOKE INHALATION

I	P	
S	S	Assess Severity: Determine Mild, Moderate, Severe Exposure
S	S	Treatment Mild Exposure: • 100% O2 via NRM • Monitor Pulse Oximetry • Monitor ECG • Monitor CO (if available) • Treat other presenting symptoms(chest pain, wheezing)
S	S	Treatment Moderate Exposure: • 100% O2 via NRM or BVM • CPAP or Intubate as indicated • Collect Blood Samples • IV/NS 100ml/hour • Monitor ECG, Pulse Oximetry, CO • SBP < 90, Give 250ml fluid bolus • Emergent Transport • Treat other presenting symptoms (chest pain, wheezing)
O	S	CyanoKit™ 5 grams IV piggyback over 15 minutes
S	S	Treatment Severe Exposure: • 100% O2 via NRM or BVM • Collect Blood Samples • IV/NS 100ml/hour • CyanoKit™ 5 grams IV piggyback over 15 minutes • CPAP or Intubate as indicated • Monitor ECG, Pulse Oximetry, CO • SBP < 90, Give 250ml fluid bolus • Treat other presenting symptoms(chest pain, wheezing)

Notes:
1. Remove patient from source if wearing appropriate PPE.
2. Known or suspected exposure to Carbon Monoxide (CO), Cyanide (CN) or both.
3. Assessment:
   - Evidence trauma/burns → C-spine, Trauma protocol
   - Soot in nose/mouth/oropharynx
   - Airway/Breathing
   - Circulation-BP, perfusion
   - LOC-GCS, pupil size/reactivity
4. Pulse Oximetry can be falsely elevated with Cyanide and/or Carbon monoxide toxicity. End tidal CO2 will rise as the body undergoes anaerobic metabolism and increasing acidosis.

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Each Cyanokit carton (NDC 49502-550-2) consists of the following:

- 2@ 250 mL glass vials, each containing lyophilized hydroxocobalamin for injection, 2.5grams
- Two sterile transfer spikes
- One sterile IV infusion set
- One quick use reference guide
- One package insert
- Diluent (Normal Saline Solution) is not included

Procedure:

1. BASELINE Vital Signs
2. Establish IV access.
3. Hang 1 liter bag 0.09% Normal Saline Solution (NSS) at KVO rate.
4. Reconstitute each 2.5 gram glass vial by adding 100ml Diluent using the supplied sterile transfer spikes.
5. NSS is the preferred Diluent. However, D5W and LR may be used.
6. The line on the vial label represents 100ml.
7. Invert or rock vials for 30 seconds prior to administration, do not shake.
8. Examine the solution, it should be dark red and have no particulate matter. If found, discard vials.
9. Administer all of the fluid over 15 minutes (~15 ml/minute), or 7.5 minutes per vial.
10. Repeat Vital Signs every 5 minutes.
11. Assess patient response to therapy.

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I. General Drug Class: Cyanide (CN) Antidote

II. Pharmacologic Drug Class:
Hydroxocobalamin

III. Pharmacology

Hydroxocobalamin, the active ingredient in Cyanokit™, is the hydroxylated active form of vitamin B12. The action of Cyanokit in the treatment of cyanide poisoning is based on its ability to bind cyanide ions. Each Hydroxocobalamin molecule can bind one cyanide ion by substituting it for the hydroxo ligand linked to the trivalent cobalt ion, to form cyanocobalamin, which is then excreted in the urine.
Cyanide is an extremely toxic poison. In the absence of rapid and adequate treatment, exposure to a high dose of cyanide can result in death within minutes due to the inhibition of cytochrome oxidase resulting in arrest of cellular respiration. Specifically, cyanide binds rapidly with cytochrome a3, a component of the cytochrome c oxidase complex in mitochondria. Inhibition of cytochrome a3 prevents the cell from using oxygen and forces anaerobic metabolism, resulting in lactate production, cellular hypoxia and metabolic acidosis. In massive acute cyanide poisoning, the mechanism of toxicity may involve other enzyme systems as well. Signs and symptoms of acute systemic cyanide poisoning may develop rapidly within minutes, depending on the route and extent of cyanide exposure.

IV. Indications

A. Cyanokit™ is indicated for the treatment of known or suspected cyanide poisoning.

B. Identifying Patients with Cyanide Poisoning

Cyanide poisoning may result from inhalation, ingestion, or dermal exposure to various cyanide-containing compounds, including smoke from closed-space fires. Sources of cyanide poisoning include hydrogen cyanide and its salts, cyanogenic plants, aliphatic nitriles, and prolonged exposure to sodium nitroprusside.
The presence and extent of cyanide poisoning are often initially unknown. There is no widely available, rapid, confirmatory cyanide blood test. Treatment decisions must be made on the basis of clinical history and signs and symptoms of cyanide intoxication. If clinical suspicion of cyanide poisoning is high, Cyanokit™ should be administered without delay.

Table 1 Common signs and Symptoms of Cyanide Poisoning Symptoms
- Headache
- Confusion
- Dyspnea
- Chest tightness
- Nausea

Signs
· Altered Mental Status (e.g., confusion, disorientation)
· Seizures or Coma
· Mydriasis
· Tachypnea / Hyperpnea (early)
· Bradypnea / Apnea (late)
· Hypertension (early) / Hypotension (late)
· Cardiovascular collapse
· Vomiting
· Plasma lactate concentration ³8 mmol/L

In some settings, panic symptoms including tachypnea and vomiting may mimic early cyanide poisoning signs. The presence of altered mental status (e.g., confusion and disorientation) and/or mydriasis is suggestive of true cyanide poisoning although these signs can occur with other toxic exposures as well. The expert advice of a regional poison control center may be obtained by calling 1-800-222-1222.

C. Smoke Inhalation

Not all smoke inhalation victims will have cyanide poisoning and may present with burns, trauma, and exposure to other toxic substances making a diagnosis of cyanide poisoning particularly difficult. Prior to administration of Cyanokit, smoke-inhalation victims should be assessed for the following:

· Exposure to fire or smoke in an enclosed area
· Presence of soot around the mouth, nose or oropharynx
· Altered mental status

Although hypotension is highly suggestive of cyanide poisoning, it is only present in a small percentage of cyanide-poisoned smoke inhalation victims. Also indicative of cyanide poisoning is a plasma lactate concentration ³10 mmol/L (a value higher than that typically listed in the table of signs and symptoms of isolated cyanide poisoning because carbon monoxide associated with smoke inhalation also contributes to lactic acidemia). If cyanide poisoning is suspected, treatment should not be delayed to obtain a plasma lactate concentration.

V. Adverse Reactions

A. Most Frequent:
- Chromaturia (red colored urine)
- Erythema
- Rash (acneiform)

B. Less Frequent
- Elevated Blood Pressure
- Nausea
- Headache
- Infusion site reaction

VI. Precautions

A. Transient increase in blood pressure

B. Interference with Laboratory Evaluations
C. Photosensitivity

VII. Pregnancy/Lactation

A. Pregnancy:Teratogenic Effects: **Pregnancy Category C**.

	Pregnancy Category	Explanation
All Trimesters	C	Animal studies are insufficient with respect to effects on pregnancy and embryo-fetal development. There are no adequate and well-controlled studies in pregnant women. Cyanokit™ should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

B. Lactation: Nursing Mothers: It is not known whether hydroxocobalamine is excreted in human milk. However, because Cyanokit™ may be administered in life-threatening situations, breast-feeding is not a contraindication to its use. Because many drugs are excreted in human milk, caution should be exercised following hydroxocobalamin administration to a nursing woman. There are no data to determine when breastfeeding may be safely restarted following administration of hydroxocobalamin.

VIII. Administration

A. Dosing

The starting dose of hydroxocobalamin for adults is 5 g (i.e., both 2.5g vials) administered as an intravenous (IV) infusion over 15 minutes (approximately 15 mL/min), i.e., 7.5 minutes/vial. Depending upon the severity of the poisoning and the clinical response, a second dose of 5 g may be administered by IV infusion for a total dose of 10 g. The rate of infusion for the second dose may range from 15 minutes (for patients in extremis) to two hours, as clinically indicated.

B. Preparation of Solution for Infusion

Each 2.5 g vial of hydroxocobalamin for injection is to be reconstituted with 100 mL of diluent (not provided with Cyanokit) using the supplied sterile transfer spike. The recommended diluent is 0.9% Sodium Chloride injection (0.9% NaCl). Lactated Ringers injection and 5% Dextrose injection (D5W) have also been found to be compatible with hydroxocobalamin and may be used if 0.9% NaCl is not readily available. The line on each vial label represents 100 mL volume of diluent. Following the addition of diluent to the lyophilized powder, each vial should be repeatedly inverted or rocked, not shaken, for at least 30 seconds prior to infusion. Hydroxocobalamin solutions should be visually inspected for particulate matter and color prior to administration. If the reconstituted solution is not dark red or if particulate matter is seen after the solution has been appropriately mixed, the solution should be discarded.

C. Pediatric Use

Safety and effectiveness of Cyanokit™ have not been established in this population. In non-US marketing experience, a dose of 70 mg/kg has been used to treat pediatric patients. A general rule is dose 2.5 gram <35 kg.

IX. Incompatibility Information

Physical incompatibility (particle formation) was observed with the mixture of hydroxocobalamin in solution and the following drugs:

- Diazepam
- Dobutamine
- Dopamine
- Fentanyl
- Nitroglycerin
- Pentobarbital
- Propofol
- Thiopental
- Blood Products

Consequently, these drugs should not be administered simultaneously through the same IV line as hydroxocobalamin.

X. Storage of Reconstituted Drug Product

Once reconstituted, hydroxocobalamin is stable for up to 6 hours at temperatures not exceeding 40°C (104°F). Do not freeze. Any reconstituted product not used by 6 hours should be discarded.

XI. HOW SUPPLIED

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XII. Storage

A. Lyophilized form: Store at 25°C (77°F); excursions permitted to 15-30°C (59 to 86°F) [see USP Controlled Room Temperature]. Cyanokit may be exposed during short periods to the temperature variations of usual transport (15 days submitted to temperatures ranging from 5 to 40°C (41 to 104°F), transport in the desert (4 days submitted to temperatures ranging from 5 to 60°C (41 to 140°F)) and freezing/defrosting cycles (15 days submitted to temperatures ranging from -20 to 40°C (-4 to 104°F).

B. Reconstituted solution: Store up to 6 hours at a temperature not exceeding 40°C (104°F). Do not freeze. Discard any unused portion after 6 hours.